Beyond Process Mining: From the Past to Present and Future

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ProM

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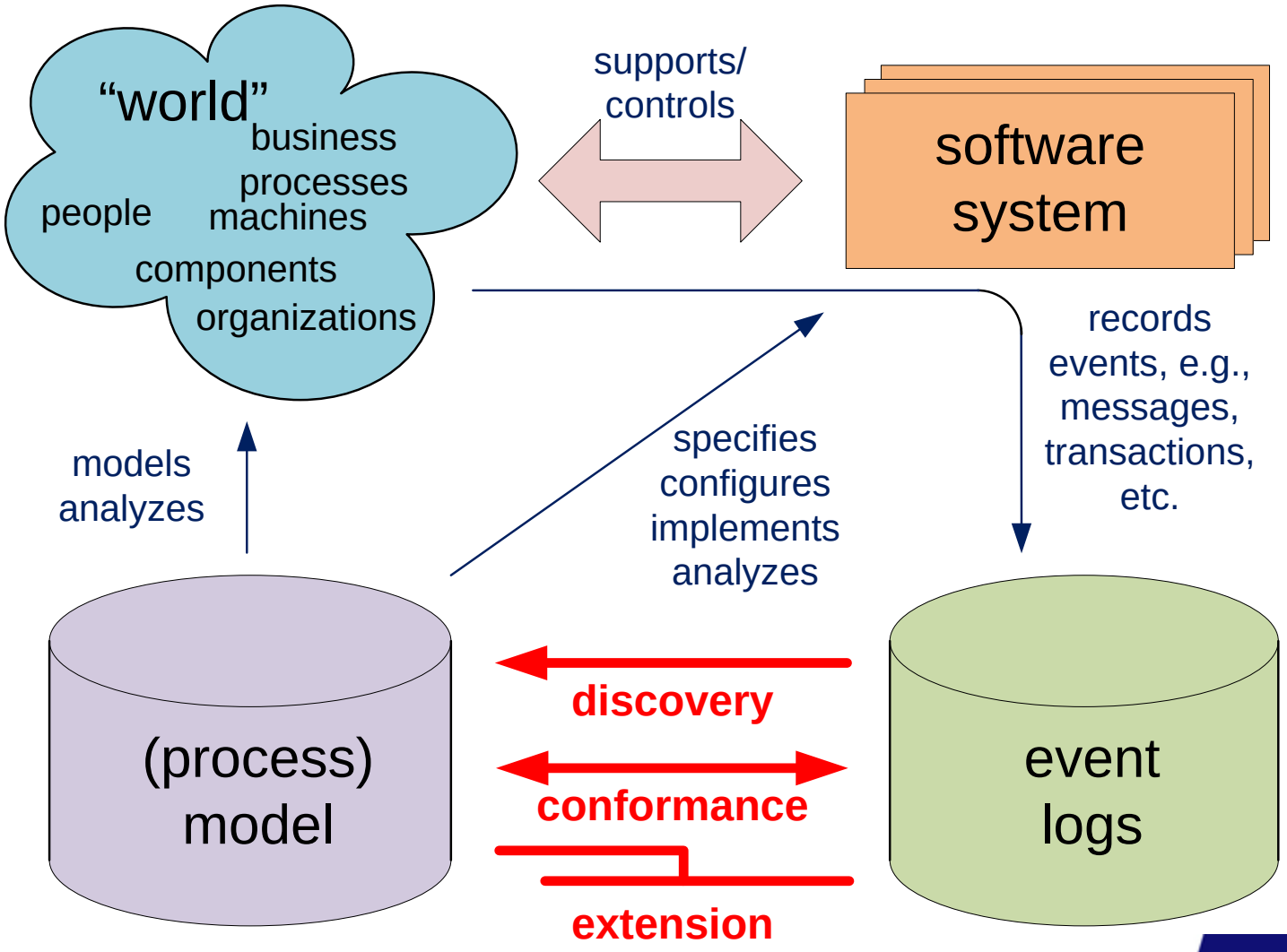
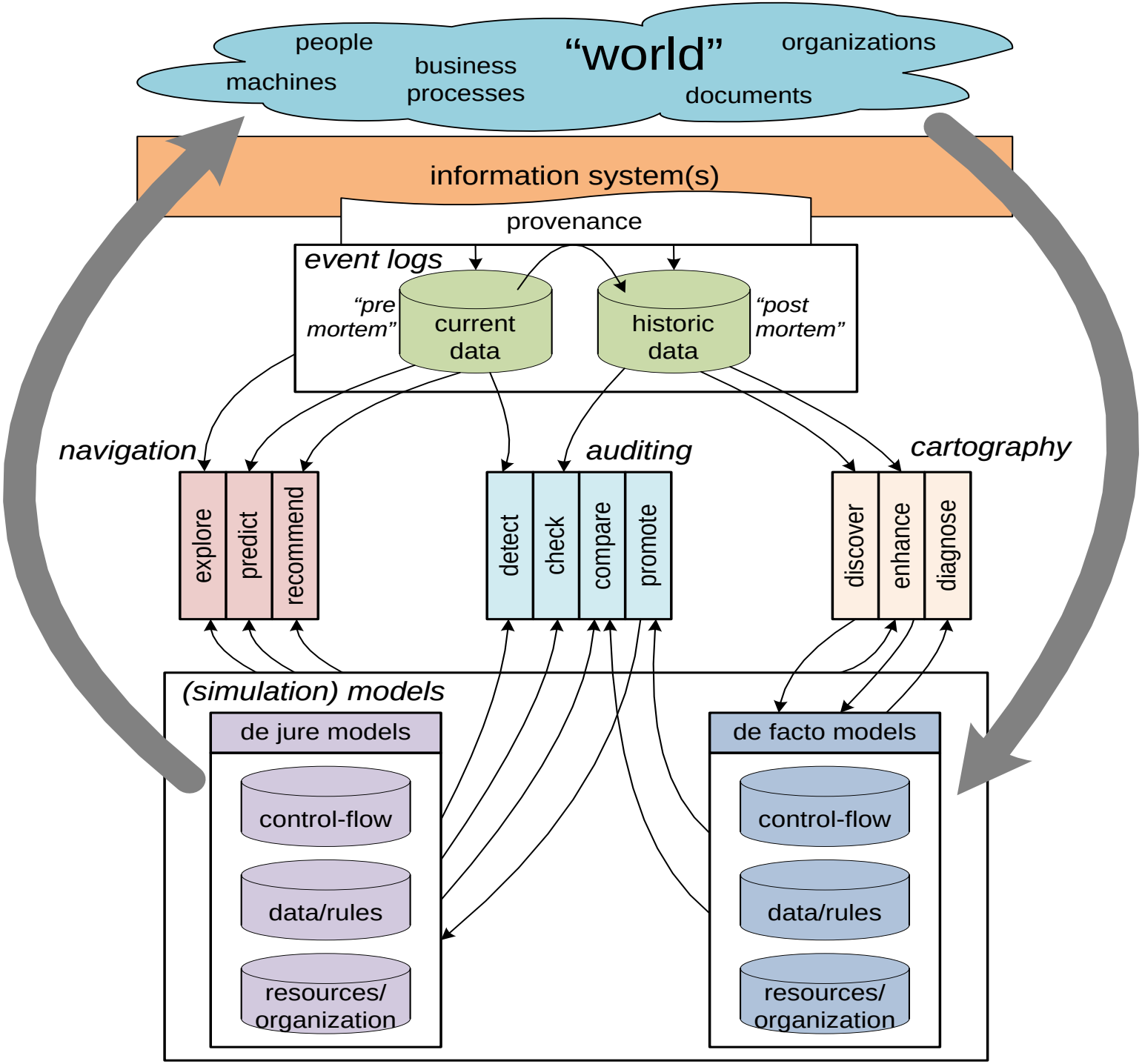
Where innovation starts

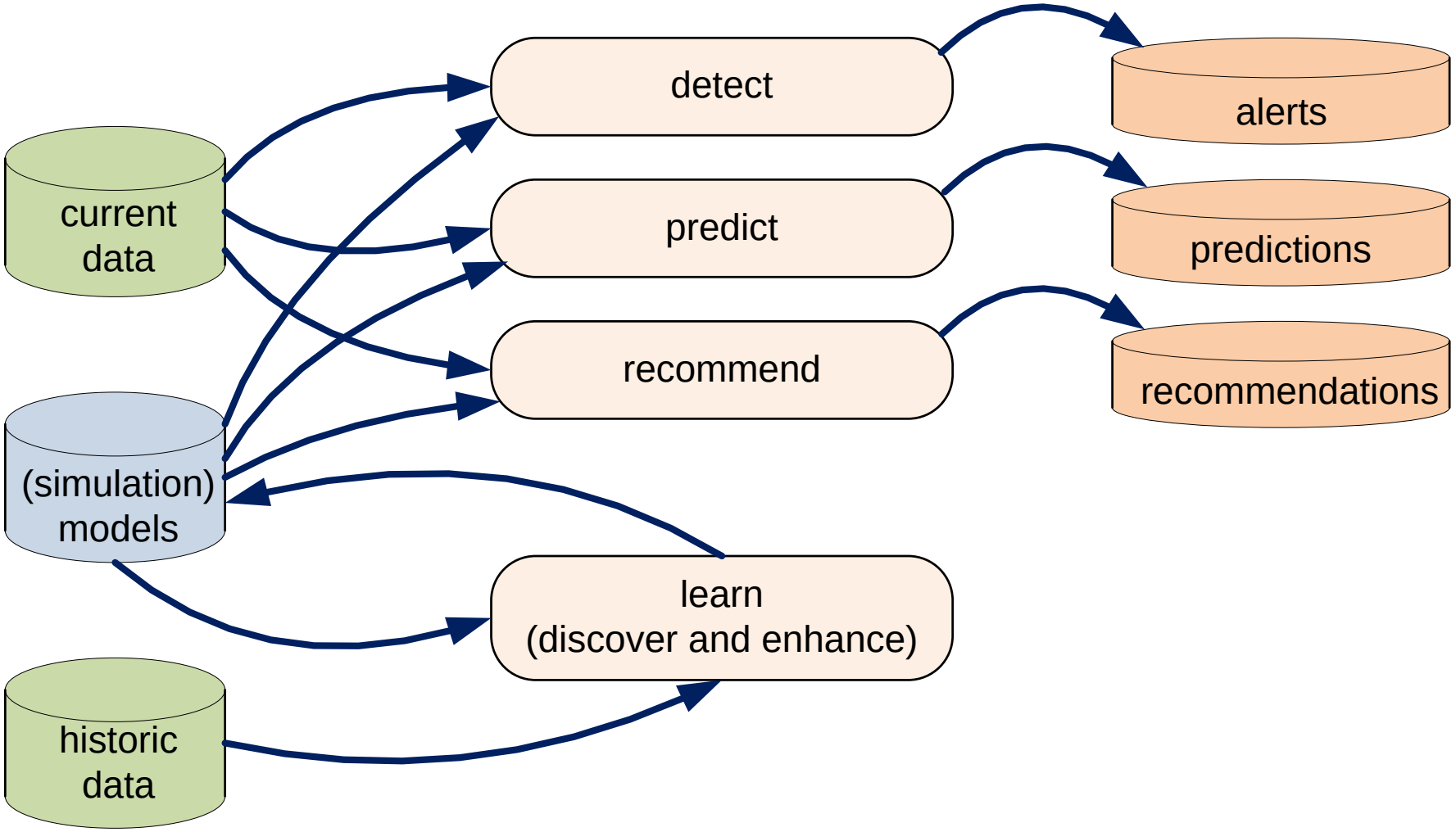
Process mining: Classical View




STEVEN SPIELBERG Presents
BACK TO THE FUTURE
A ROBERT ZEMECKIS Film


people
machines
business processes
"world"
organizations
documents
information system(s)
provenance
event logs
"pre mortem"
current data
historic data
"post mortem"
navigation
explore
predict
recommend
auditing
detect
check
compare
promote
cartography
discover
enhance
diagnose
(simulation) models
de jure models
control-flow
data/rules
resources/ organization
de facto models
control-flow
data/rules
resources/ organization

Operational Support: Detect, Predict, and Recommend



Recommend: How to get home ASAP? Take a left turn!

Detect: You drive too fast!

Predict: When will I be home? At 11.26!

Operational Support Based on Replay

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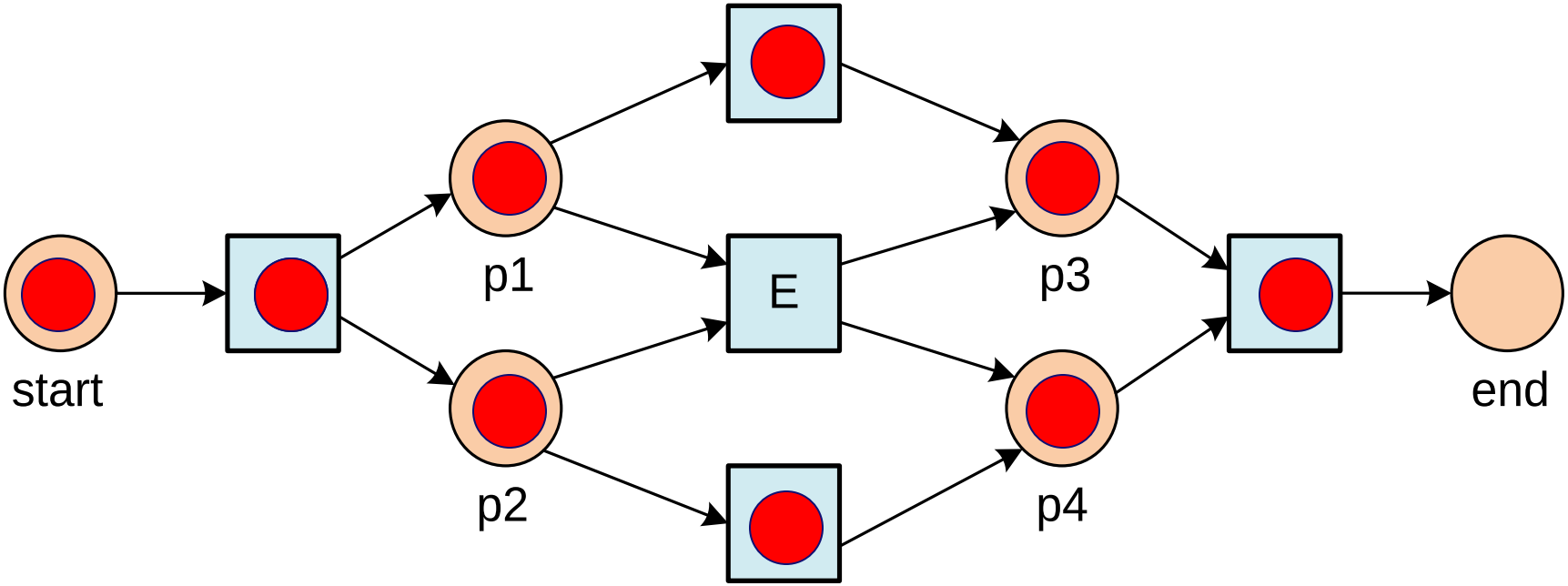
Play Out (Classical use of models)



A B C D

A E D

A E D

A B C D

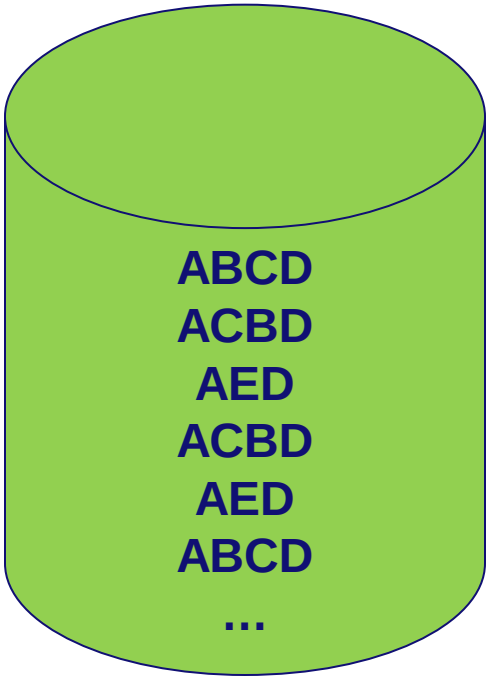
A C B D

A C B D

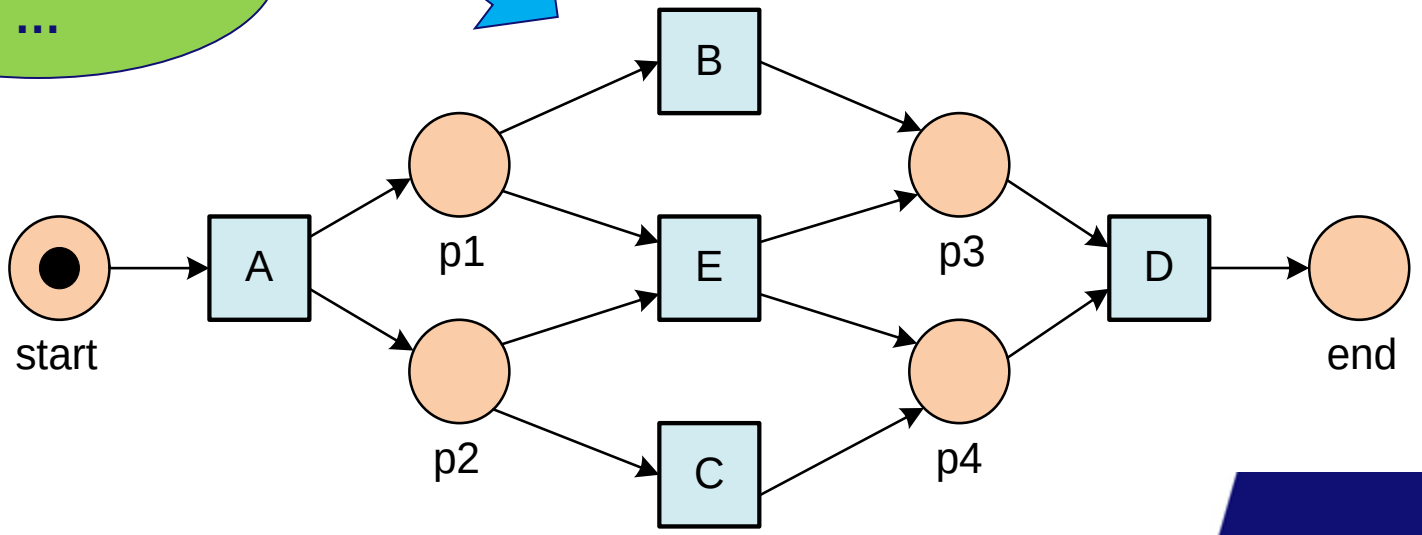
A E D

A C B D

Play In (Process Discovery)

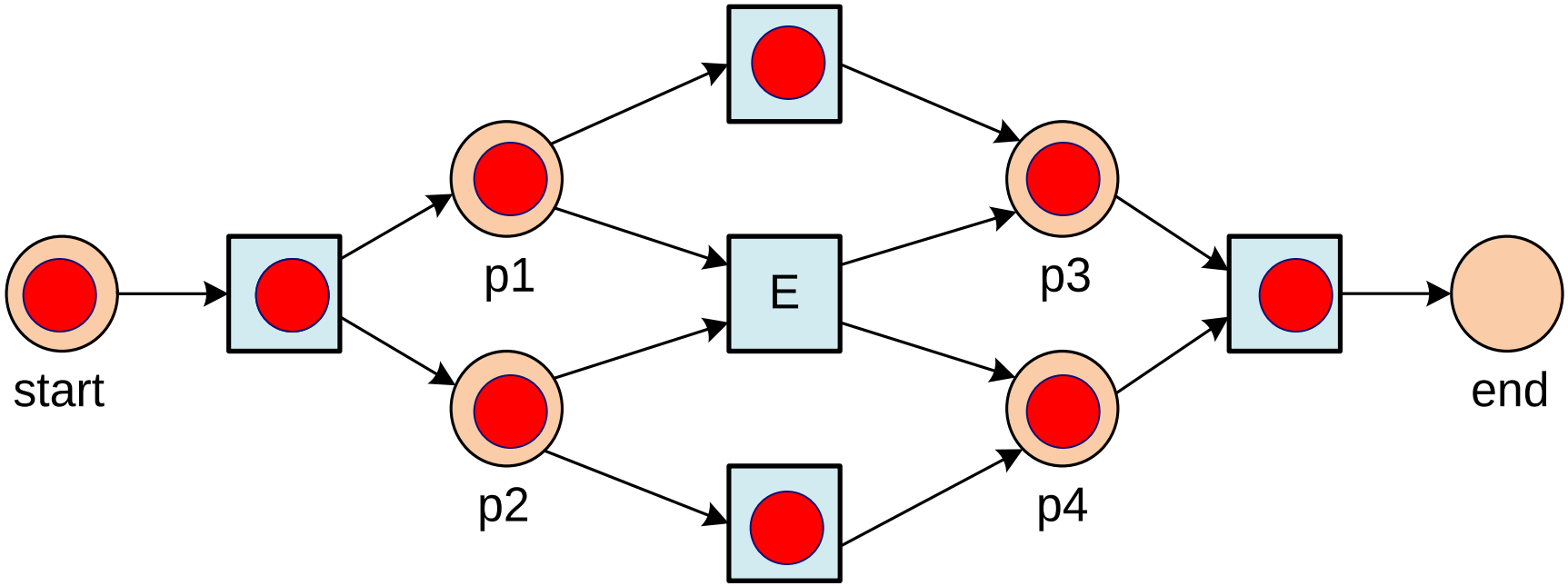


a process discovery algorithm like the α algorithm



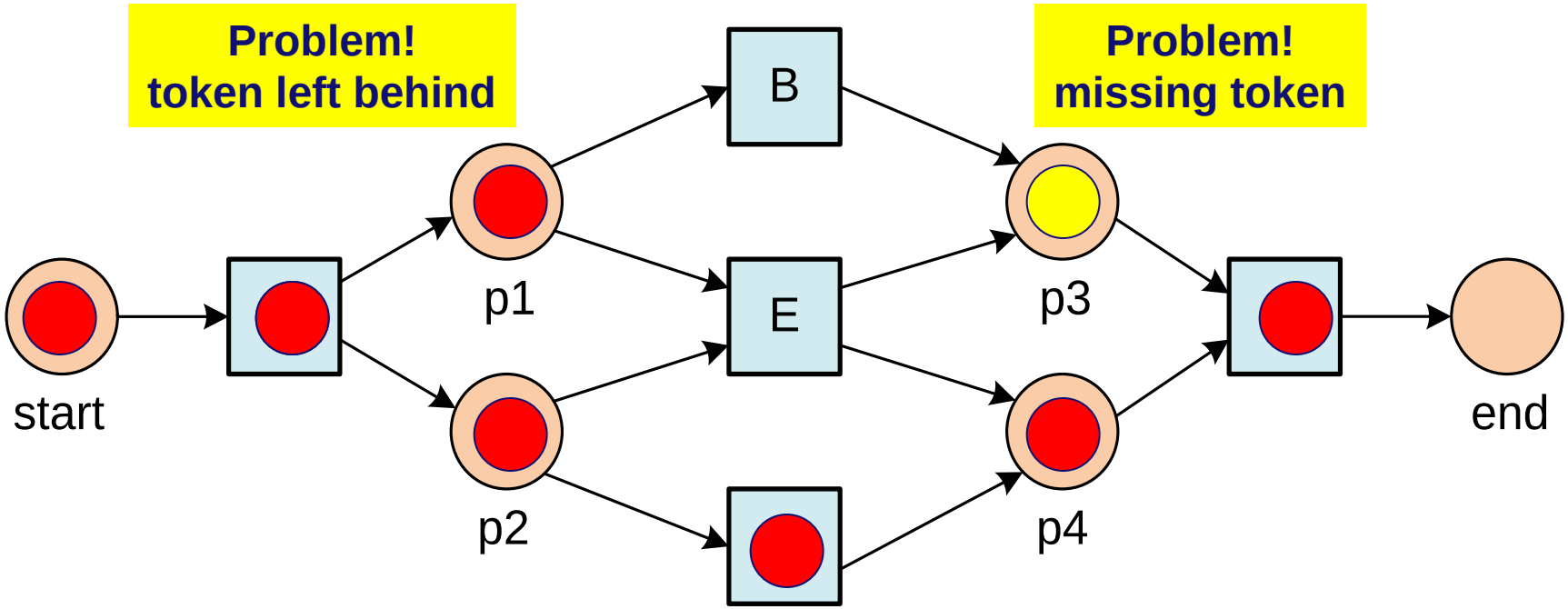
Replay

A B C D



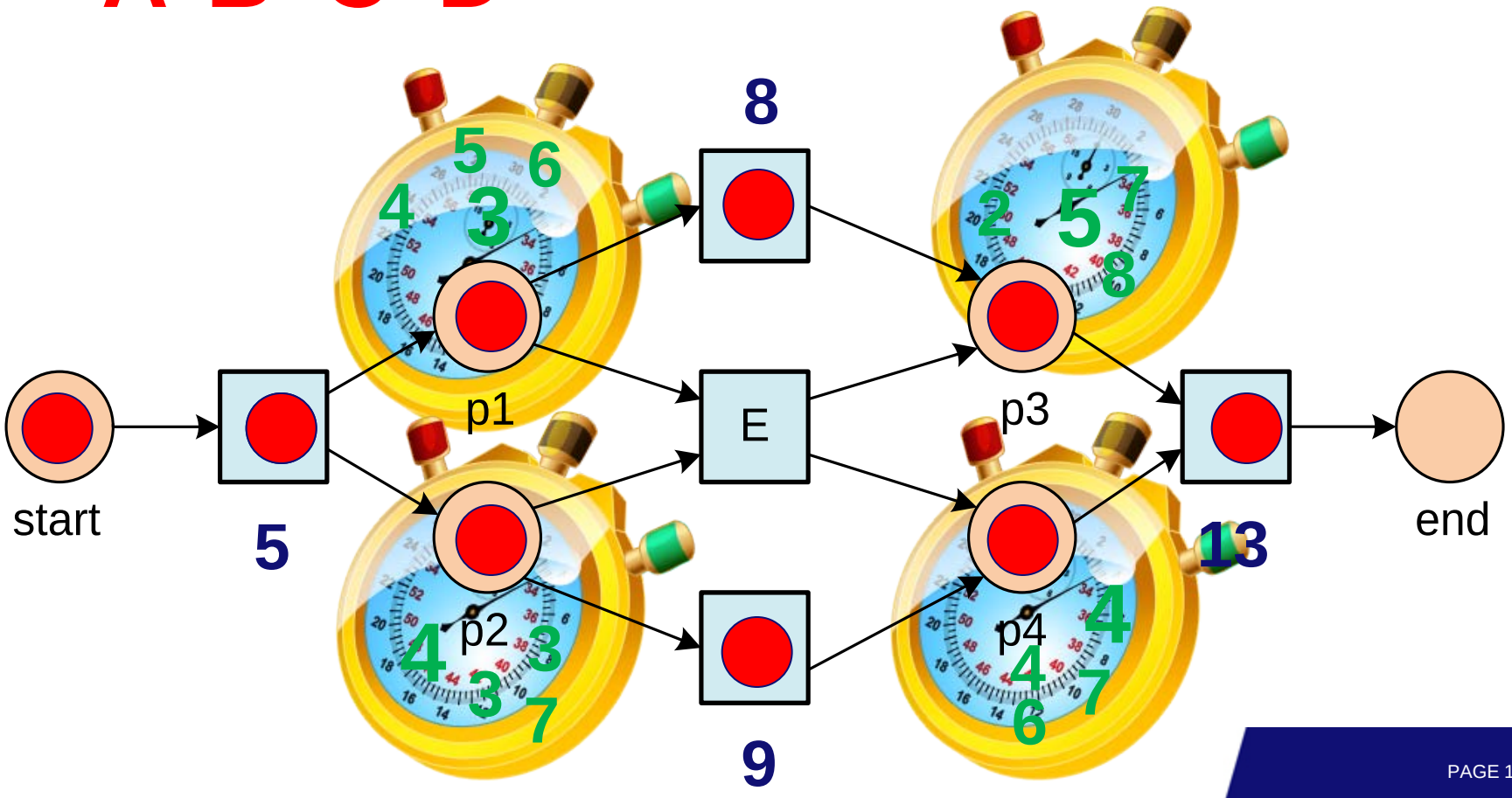
Replay can detect problems

A C D



Replay can extract timing information

$A^5 B^8 C^9 D^{13}$



Example: Time-based Operational Support (TOS)

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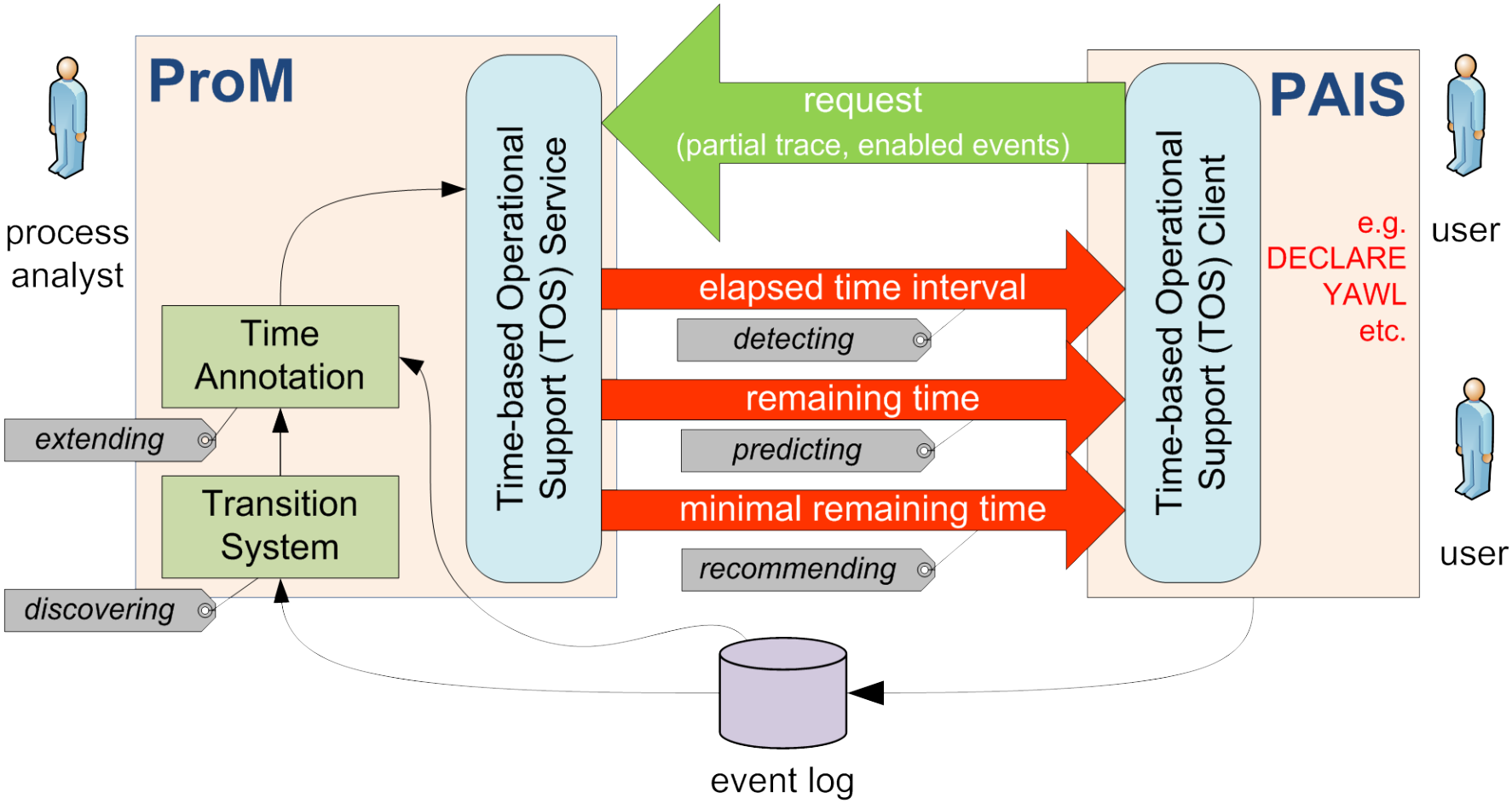
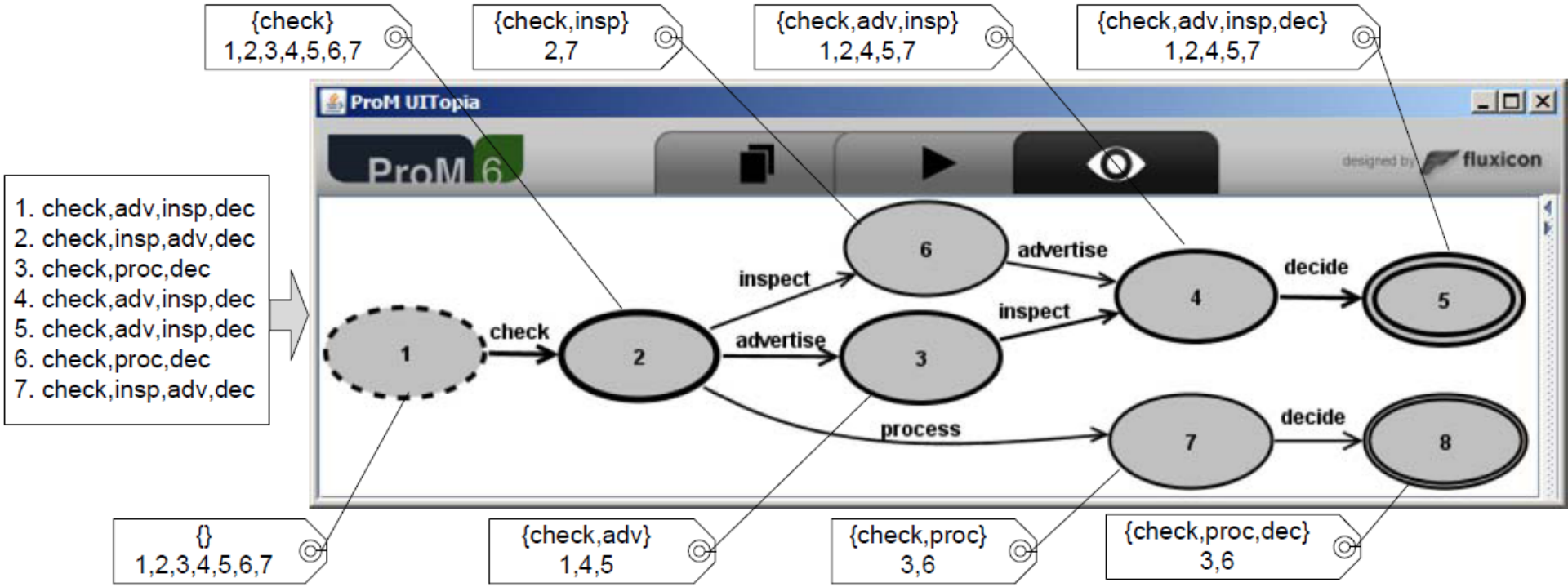
Architecture

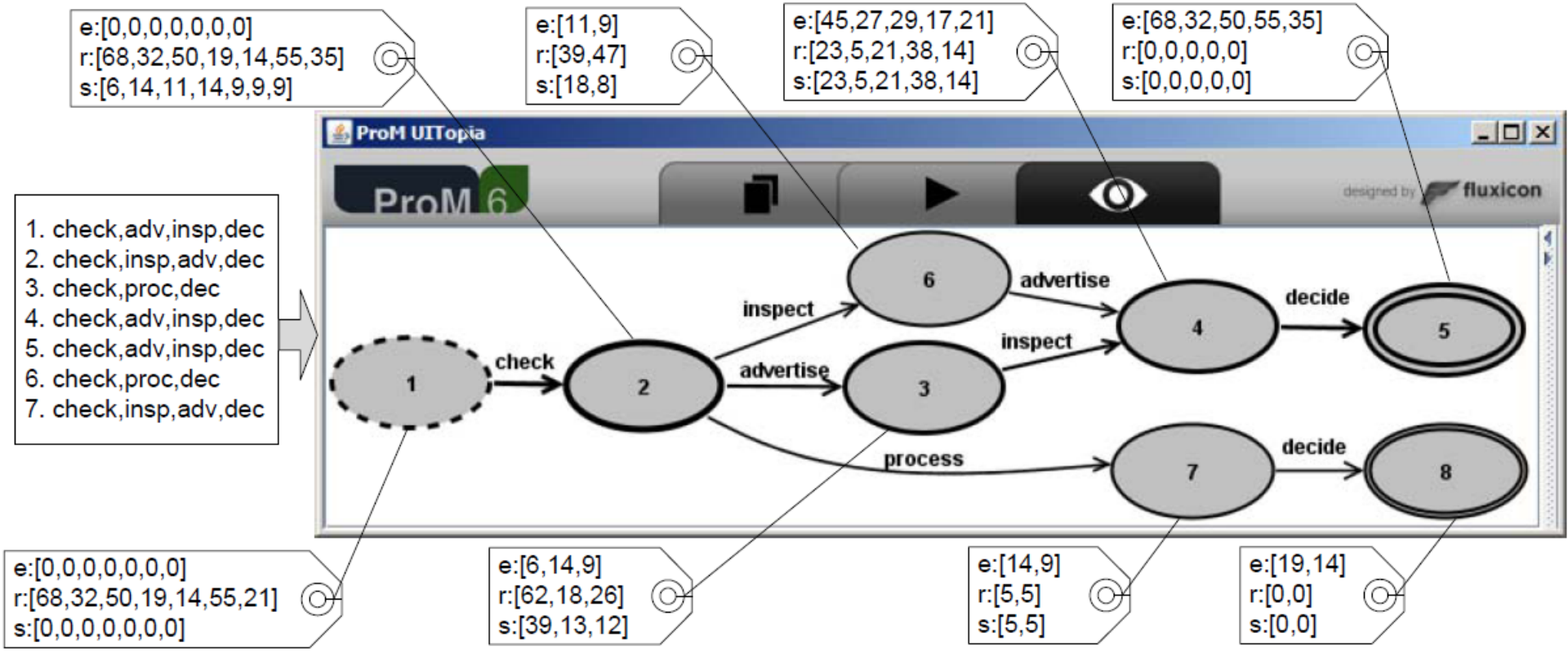


Step 1: Learn Transition System



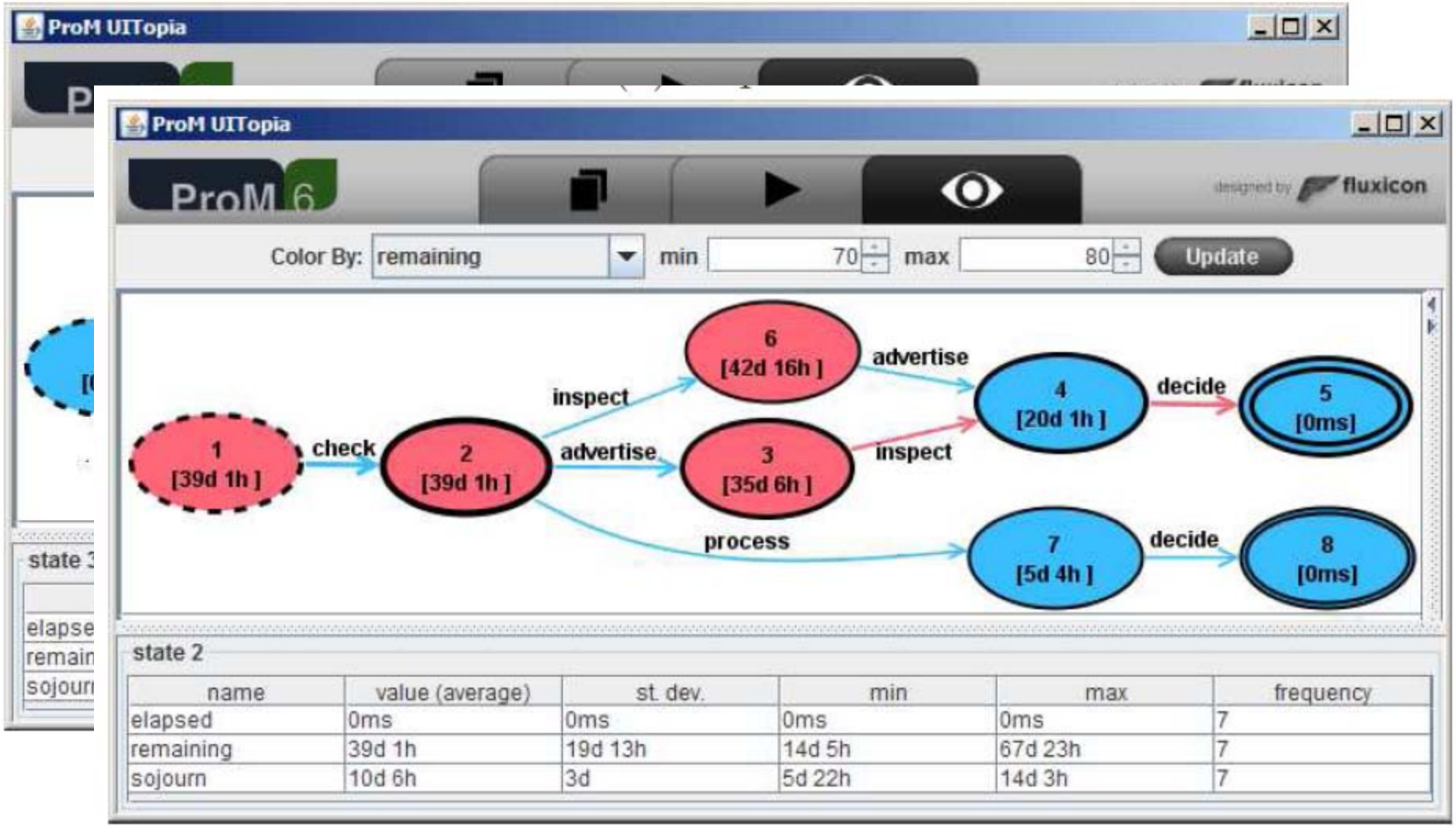
Prefix-set-activity abstraction is used here.
Other abstractions possible.

Step 2: Replay Log for Time Information



e=elapsed, r=remaining, and s=sojourn.

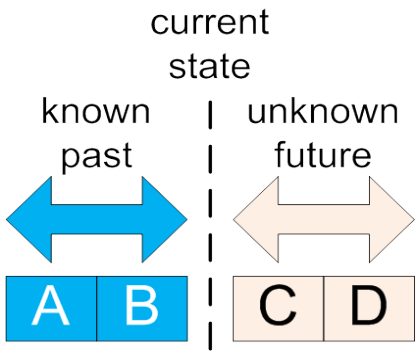
Step 3: Calculate statistics

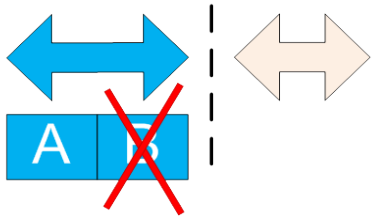


name	value (average)	st. dev.	min	max	frequency
elapsed	0ms	0ms	0ms	0ms	7
remaining	39d 1h	19d 13h	14d 5h	67d 23h	7
sojourn	10d 6h	3d	5d 22h	14d 3h	7

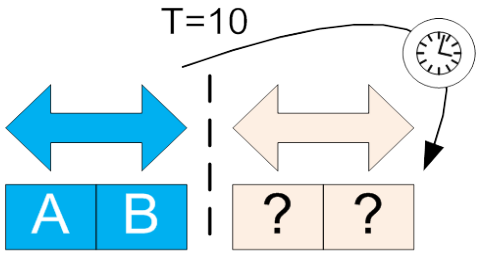
(b) remaining times

Step 4: Start Operational Support

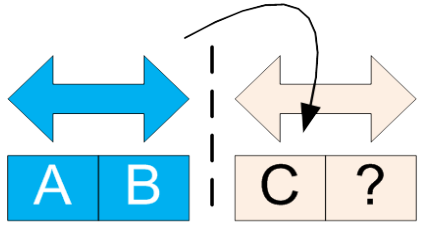




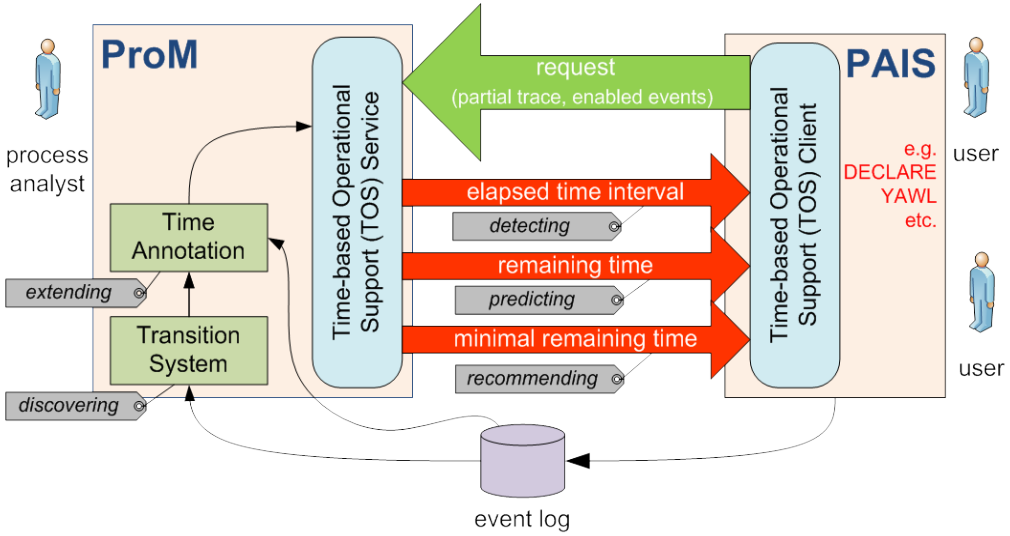
***detect**: B does not fit the model (not allowed, too late, etc.)*

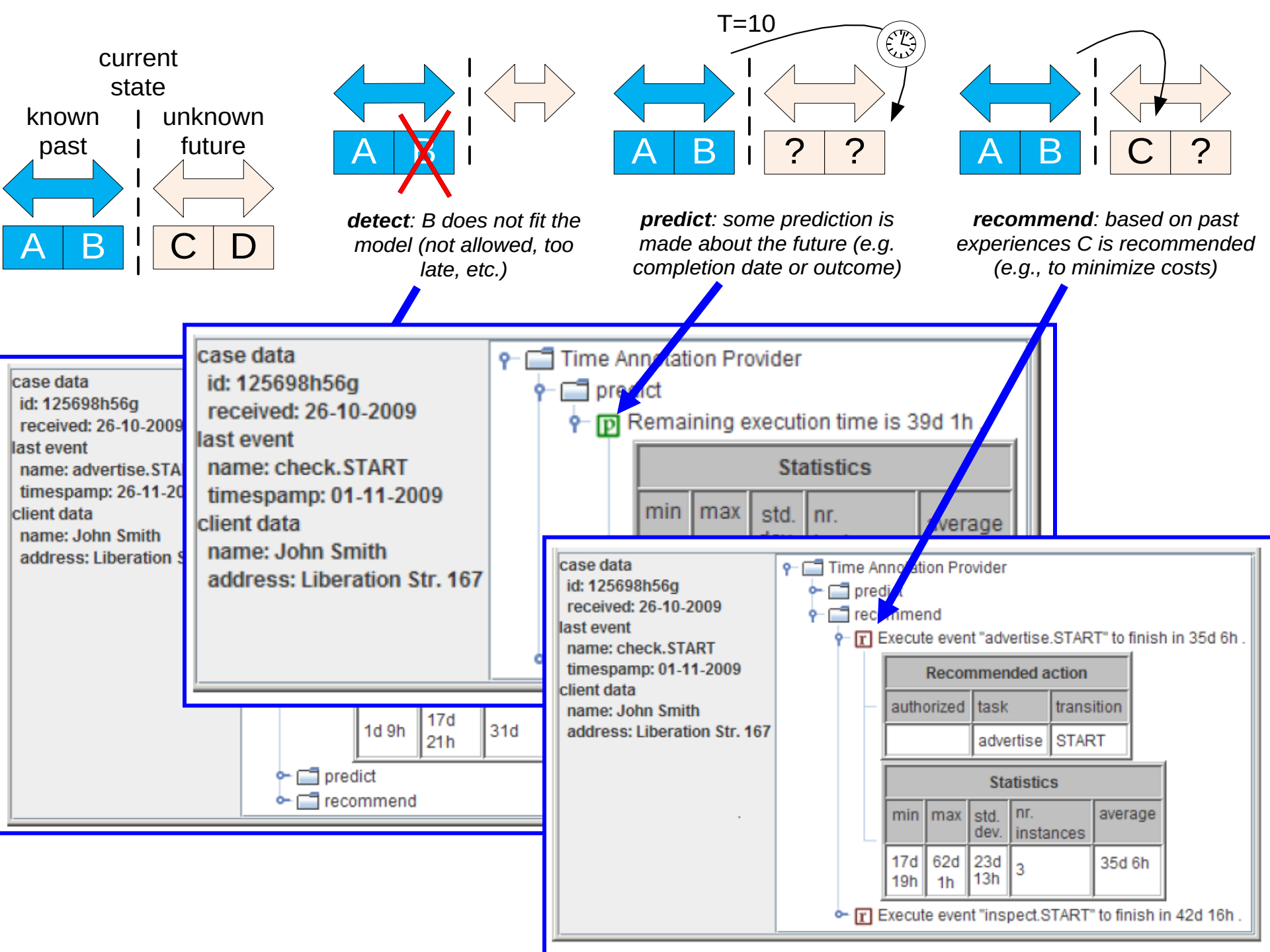


***predict**: some prediction is made about the future (e.g. completion date or outcome)*



***recommend**: based on past experiences C is recommended (e.g., to minimize costs)*

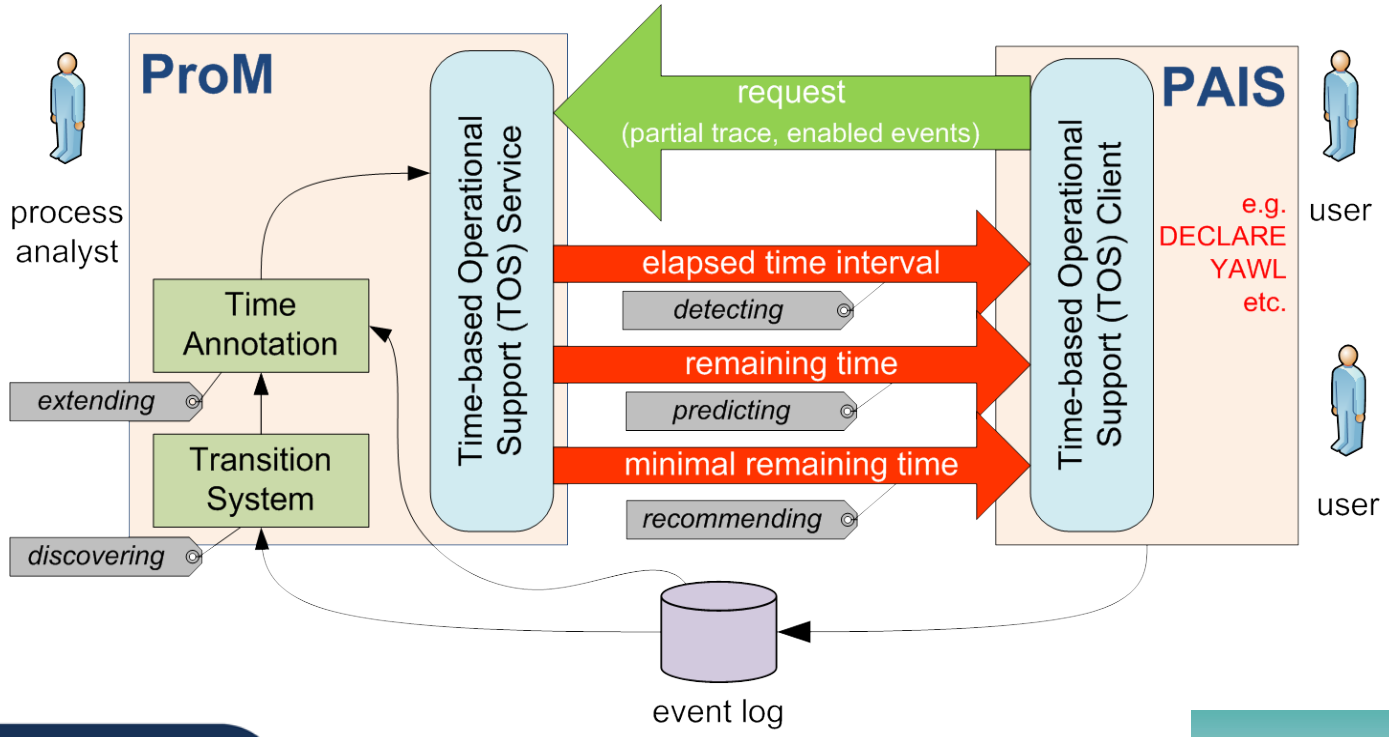



current state
known past
unknown future
A
B
C
D
T=10
?
?
detect: B does not fit the model (not allowed, too late, etc.)
predict: some prediction is made about the future (e.g. completion date or outcome)
recommend: based on past experiences C is recommended (e.g., to minimize costs)
case data
id: 125698h56g
received: 26-10-2009
last event
name: check.START
timespamp: 01-11-2009
client data
name: John Smith
address: Liberation Str. 167
Time Annotation Provider
predict
Remaining execution time is 39d 1h
Statistics
min
max
std.
nr.
average
1d 9h
17d 21h
31d
recommend
Execute event "advertise.START" to finish in 35d 6h .
Recommended action
authorized
task
transition
advertise
START
std. dev.
nr. instances
17d 19h
62d 1h
23d 13h
3
35d 6h
Execute event "inspect.START" to finish in 42d 16h .

Conclusion

Conclusion

Operational Support



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prom.sourceforge.net

www.yawlfoundation.org

www.win.tue.nl/declare/

More on building transition systems annotated with time …

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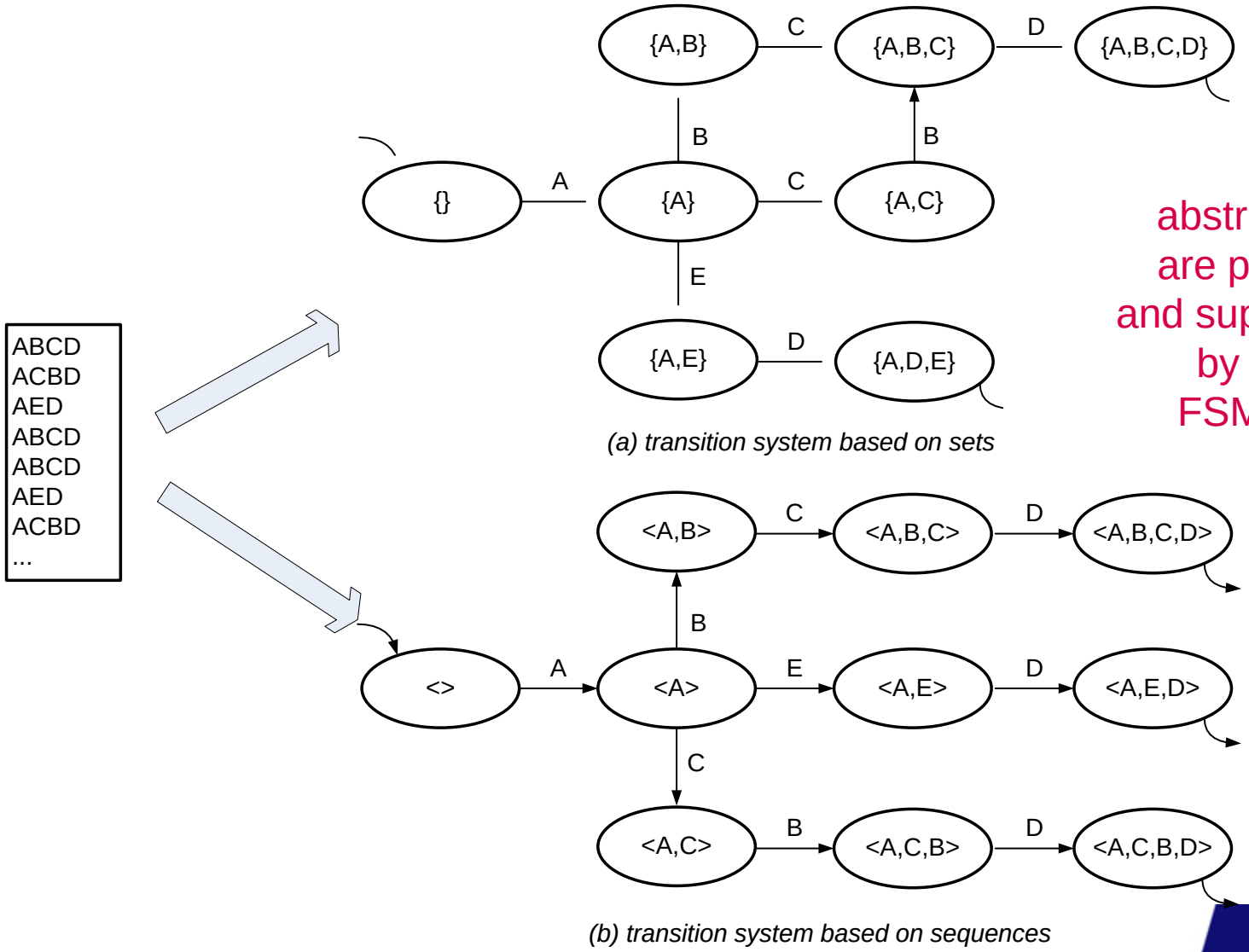
Input

event id	properties				
	timestamp	activity	resource	cost	...
35654423	30-12-2008:11.10	A	John	300	...
35654424	30-12-2008:15.21	B	John	400	...
35654425	30-12-2008:15.35	C	John	100	...
35654426	30-12-2008:15.55	D	John	400	...
35655526	29-12-2008:16.15	A	Ann	300	...
35655527	30-12-2008:16.05	C			
35655528	30-12-2008:16.25	B			
35655529	31-12-2008:10.55	D			
...	...	...			

1	$\langle A^{00}, B^{06}, C^{12}, D^{18} \rangle$
2	$\langle A^{10}, C^{14}, B^{26}, D^{36} \rangle$
3	$\langle A^{12}, E^{22}, D^{56} \rangle$
4	$\langle A^{15}, B^{19}, C^{22}, D^{28} \rangle$
5	$\langle A^{18}, B^{22}, C^{26}, D^{32} \rangle$
6	$\langle A^{19}, E^{28}, D^{59} \rangle$
7	$\langle A^{20}, C^{25}, B^{36}, D^{44} \rangle$

Building transition systems



(a) transition system based on sets

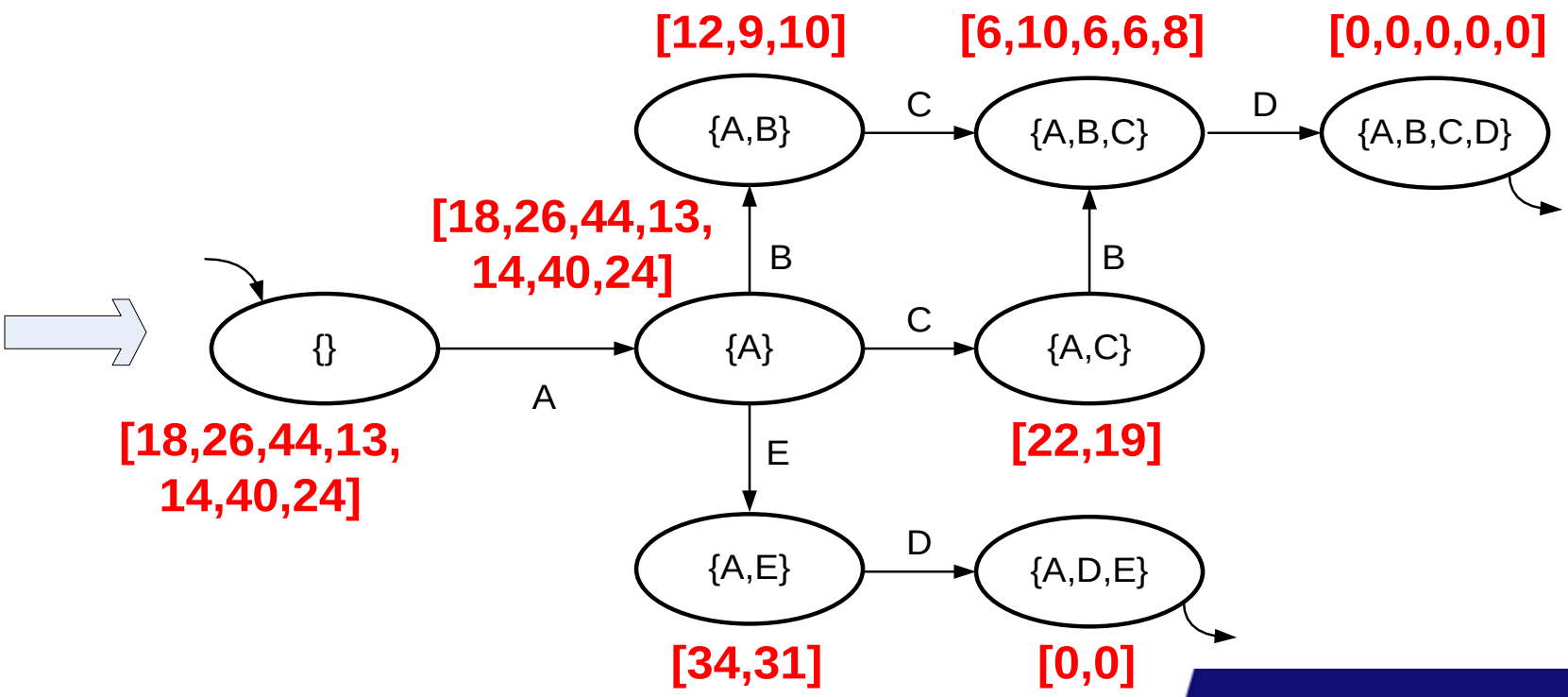
(b) transition system based on sequences

many abstractions are possible and supported by ProM's FSM miner

Annotated transition system based on remaining time

1	$\langle A^{00}, B^{06}, C^{12}, D^{18} \rangle$
2	$\langle A^{10}, C^{14}, B^{26}, D^{36} \rangle$
3	$\langle A^{12}, E^{22}, D^{56} \rangle$
4	$\langle A^{15}, B^{19}, C^{22}, D^{28} \rangle$
5	$\langle A^{18}, B^{22}, C^{26}, D^{32} \rangle$
6	$\langle A^{19}, E^{28}, D^{59} \rangle$
7	$\langle A^{20}, C^{25}, B^{36}, D^{44} \rangle$

ABCD
ACBD
AED
ABCD
ABCD
AED
ACBD



Predictive information